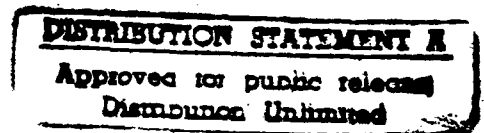


**Special Report 30**

**National Training Center  
Research Element  
Fort Irwin, California  
1986-1996**

**Robert H. Sulzen**  
U.S. Army Research Institute



**February 1997**

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# FOREWORD

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In 1986, the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) established a Research Team, which was later changed to a Research Element, at Fort Irwin, California. The goal of the team was to perform research and to improve tactical training at the National Training Center (NTC). In the ensuing decade, the ARI-NTC Research Team/Element made significant contributions to the understanding of NTC performance and to Army lessons learned.

On 10 June 1996, as a result of downsizing, the research element was closed with its functions transferred to other ARI research units.

In the tradition of military unit histories, this report summarizes the programs and accomplishments of the Fort Irwin Research Element and provides a reference list of documents reflecting those accomplishments.

ZITA M. SIMUTIS  
Deputy Director  
(Science and Technology)

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Director

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## Background

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The U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) established a Research Team, later changed to a Research Element, at the National Training Center (NTC), Fort Irwin, California in June 1986. The ARI-NTC Research Team/Element was part of the Monterey Field Unit, the latter being renamed the Unit Collective Training Research Unit, until it was closed in June 1995. In the final year, the ARI-NTC Research Element was attached to the Armored Forces Research Unit, Fort Knox, Kentucky. The requirement for a Research Team/Element was developed with the Combined Arms Command Deputy Commander—Training (CAC-TNG) through the Center for Army Lessons Learned (CALL), Fort Leavenworth, Kansas.

The Monterey Field Unit established the ARI-NTC Research Team to support the National Training Center (NTC) Observation Division (NOD). A letter of agreement was signed between CAC-TNG and ARI on 16 September 1985. It focused on cooperation between the organizations related to the second mission of the NTC, specifically providing information to improve Army training performance and readiness.

The first mission of the NTC was seen as providing the most realistic, dynamic, and tough joint/combined arms training to battalion task forces and brigades as was possible. However, the second mission of NTC, to provide lessons learned through training feedback, was not accomplished as well. The ARI-NTC Research Team was to provide research and development support to the NOD and NTC to improve feedback, assess performance, and archive data related to NTC unit performance.

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# Research Products and Programs

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## National Training Center Guidebooks

Early in the ARI-NTC Research Team's history, there was a requirement to assist the NTC Observer/Controllers (O/Cs) by developing, with NTC participation, a series of guidebooks that would assist new O/Cs in the performance of their duties. The 10 guidebooks were developed jointly by the ARI Field Unit at the Presidio of Monterey and the ARI-NTC Research Team.

The first guidebook (Meliza, Sulzen, Atwood, & Zimmerman, 1987) focused on the company and platoon O/Cs. At the request of the Commander of the Operations Group (COG) at the NTC, the guidebooks were not distributed outside the NTC. It was reasoned that if distributed they might contaminate the NTC training experience. Units might try to train to the guidebook rather than to the doctrinal mission task and requirements for separate battlefield operating systems (BOSSs). The initial distribution of the guidebooks was limited to internal NTC use only.

The company and platoon guidebook was to serve as a preliminary guide to new O/Cs until they developed their own procedures. The guidebook listed duties to be performed before, during, and after the field training exercises. The duties performed before training included checking the instrumentation on the combat vehicles, giving the unit a briefing, the methods of boresighting the firing systems, checking the multiple integrated laser engagement system (MILES), safety checks required, and the personal preparation for the exercises made by the O/C. The O/C duties listed during the exercise included those actions taken just prior to the exercise, the control tasks during an exercise, and observations to be made to prepare for the after action review (AAR). The after exercise actions listed for the company/platoon O/Cs were conduct of the final AAR for the company/team and the preparation of the company/team take-home package.

Four other guidebooks were then developed: one for the Intelligence BOS (Sulzen, 1988a), one for the Fire Support BOS (Whitmarsh, 1988a), one for the Mobility/Counter mobility BOS (Meliza, 1988a), and one for the Combat Service Support (CSS) BOS (Meliza & Sulzen, 1988a). The company/platoon guidebook was for the line units or those in direct contact with the enemy. The BOS guidebooks were for the staff O/Cs. The Intelligence Guidebook was designed for the O/C with the duty of observing the Intelligence Officer or S-2 and his staff. The Fire Support Guidebook was for the O/C observing the fire support system, including the fire support officer (FSO), the fire support element (FSE), and the fire support team (FIST) assigned to line units to provide observation and adjustment of fire. The Mobility/Counter mobility Guidebook served the Engineer O/C who had the duty to observe engineer and unit actions to facilitate friendly force movement and inhibit enemy movement. Quite a bit of the latter guidebook dealt with the tasks involved in simulated minefields. The CSS Guidebook was designed to assist in observing service support provided for the task force, including supply, maintenance, medical support, and personnel services.

Once the five force-on-force guidebooks were developed, the live fire trainers (Dragons) decided there was a need to modify the guidebooks for their purposes. During the force-on-force exercises, the simulated battle events were determined by MILES. Individual soldiers and combat vehicles would inflict or suffer casualties by this system. In the live fire exercises the MILES detection system was still worn by soldiers or mounted on combat vehicles, but the laser transmitters were removed (with the exception of antitank guided missiles). The live fire guidebooks provided additional information on the transition from force-on-force to live fire and back again, and the modifications in O/C duties required in the live fire setting. The five live fire modifications along with the original five force-on-force guidebooks produced the 10 guidebooks that were developed.

The guidebooks were modified to consider live fire differences for company/platoon O/Cs (Meliza & Sulzen, 1988c), Intelligence BOS (Sulzen, 1988b), Fire Support BOS (Whitmarsh, 1988b),



Mobility/Counter-mobility BOS (Meliza, 1988b), and Combat Service Support BOS (Meliza & Sulzen, 1988b). See Table 1. The guidebook project was documented in a presentation at the Military Testing Association (Sulzen, 1988d).

**Table 1**

*National Training Center Guidebooks by Battlefield Operating System and Category (Force-on-Force and Live Fire)*

Battlefield Operation System (BOS)	Force-on-Force Publication	Live Fire Publication
Maneuver (Company/Platoon)	NTC Guidebook for Force-on-Force Company/Platoon Observer/Controllers	NTC Guidebook for Live Fire Company/Platoon Observer/Controllers
Intelligence	NTC Guidebook for Battalion/Task Force Intelligence Observer/Controller during Force-on-Force	NTC Guidebook for Battalion/Task Force Intelligence Observer/Controller during Live Fire
Fire Support	NTC Guidebook for Fire Support Observer/Controller during Force-on-Force	NTC Guidebook for Fire Support Observer/Controller during Live Fire
Mobility/ Counter-mobility	NTC Guidebook for Force-on-Force Mobility Observer/Controller	NTC Guidebook for Live Fire Mobility Observer/Controller
Combat Service Support	NTC Guidebook for Force-on-Force Combat Service Support (CSS) Observer/Controller	NTC Guidebook for Live Fire Combat Service Support (CSS) Observer/ Controller

### **Electronic Clipboard/Data Collection Device**

To support NTC research and analysis efforts, it seemed wise to capture unit performance data for automated and reliable feedback. The concept for such a process was termed the "electronic clipboard." It was assumed that the NTC could benefit from such a device by providing consistent feedback to training units. Whitmarsh (1988c) described some of the early trials with the electronic clipboard at NTC.

In April 1994, the electronic clipboard was tried at the NTC during an Army Warfighting Experiment dealing with digitized displays available for combat vehicle commanders that displayed the location of friendly vehicles and enemy vehicles that had been engaged. The term electronic clipboard had been changed to electronic data collection device. Hiller (1994) described the promise of such a device as enabling trainers and observers to collect data on general and specific topics assisting in providing lessons learned.

### **Command Climate and Quality of Life Surveys**

In 1989, Brigadier General (BG) Funk, commander of the NTC, requested that ARI assist in conducting a survey on command climate and quality of life at Fort Irwin. ARI personnel assisted in the development of the survey and its analysis. BG Funk's successor, BG Clark, administered the first survey in 1990.

BG Laporte requested development of a similar survey to be administered in 1994. The NTC Inspector General Office carried out the survey with technical advisory support from the ARI-NTC Research Element.

### **Determinants of Effective Unit Performance**

A major project undertaken by the ARI Field Unit at the Presidio of Monterey was the Determinants of Effective Unit Performance (Holz, O'Mara, & Keesling, 1994). The purpose of the determinants project was to determine the effects of home station training on performance at

the NTC. The ARI-NTC Research Team played a significant role in the NTC data collection for this effort.

A total of seven brigade NTC rotations were used for the research. During the seven rotations, data were collected from 12 task forces and their subordinate 56 line company/teams and 168 tank or mechanized rifle platoons. Approximately 2,700 soldiers participated in these rotations. The project began in 1987 and data collection continued until 1990.

The measures for the determinants research project included structured individual interviews, group interviews, questionnaires, unit records, and NTC O/C unit ratings. The O/C ratings were collected during the rotation. The other measures were completed approximately 6 months prior to the rotation, 2 weeks prior to the rotation, and within 3 months following the rotation.

The results indicated that units expending more resources in their train-up at home station performed better at NTC. One of the resources is the number of miles driven during the train-up period. The most successful brigade in terms of missions judged effective by the O/Cs drove nearly twice as many miles as the least successful brigade. More successful units implemented the Army training management cycle more fully (Holz et al., 1994).

From the NTC performance data, Hiller, McFann, and Lehowicz (1994) demonstrated that the Ground Operating Tempo (OPTEMPO) expended by units (including that used by the opposing forces [OPFOR]) was significantly related to unit performance as measured by the casualty exchange ratio (the ratio of OPFOR combat vehicles lost to combat vehicles started divided by the same ratio for the Blue Force). These analyses were useful in defending before Congress the OPTEMPO utilized by the Army to maintain readiness.

## **Opposing Forces: Lessons Learned**

It has long been acknowledged that the NTC OPFOR perform very well because of their increased training time (Sulzen, 1987). It was postulated that some of the practices followed by the OPFOR might be useful for the training of units at their home station.

A study was undertaken of the OPFOR practices that might be adopted by tactical units in their training (Sulzen, 1993). Four practices were recommended for adoption by Army tactical units: MILES gunnery, massed fires, weapons positioning, and engagement area selection. Following these practices is more likely to produce enemy casualties while preserving friendly forces, and is likely to prove effective if practiced to standard at home station.

MILES gunnery practices by the OPFOR that differed from rotational units included daily checking of the boresighting and zeroing of the MILES and verifying the strength of the batteries in the laser transmitter. The OPFOR also established weapons crew standards for MILES firing and insisted that crews met the standards or be replaced.

Massed fires were achieved by the OPFOR as contrasted to the blue force units through extensive practice of fire commands and target reference points. The points were based on easily identified terrain features. Because blue force units do not train as often as the OPFOR, they need to conduct practice drills on massing fires.

All units position weapons. However, the OPFOR does it so often that they have a series of practices that ensure its effectiveness. Combat vehicle commanders select vehicle positions that will enable them to fire directly into engagement areas and verify that they can do so by checking at ground level. The OPFOR then has frequent opportunities to verify during simulated combat exercises that their positioning is effective. Rotational units cannot conduct these exercises as often, but there is some opportunity to conduct drills before a rotation to the combat training center. Practice and drill of these skills is likely to improve unit performance.

Engagement area selection, like the other recommended practices, requires practical experience for higher levels of performance. One approach to increase practical experience is to have a friendly combat vehicle proceed down an avenue of approach through the selected engagement area. All combat vehicles then take turns engaging the vehicle as a target, resetting the MILES following each engagement. The experience is good not only for combat vehicle crews, but also for the leader who should be present during this drill. With enough practice at home station, leaders should improve their ability to select more effective engagement areas. It is not uncommon for task forces to select engagement areas that cannot be hit from the designated battle areas for combat vehicles.

### **Tactical Training Support**

One major goal of the ARI Field Unit at the Presidio of Monterey, and likewise the ARI-NTC Research Team, was to develop training methods that could be validated in the field. The training methods were constructed to enhance collective training and, therefore, improve combat performance at the NTC.

The combat performance capabilities of the Army have been greatly increased by ARI's efforts related to tactical engagement simulation (TES). The ARI Newsletter, Spring 1995, provides a good summary of ARI's TES research. Much of the research undertaken and the reported results are presented in an annotated bibliography of TES (Sulzen, 1986). The bulk of the research was conducted in settings like the NTC, which emphasized realistic tactical environments. For this research the controller system was similar to that employed at the Combat Training Centers.

During the development of field tactical training methods, a series of techniques were found to be particularly efficient of training time expended (Sulzen, 1988c). These included a simple board game or constructive simulation, a modified tactical exercise without troops (TEWT) (which was really a reduced scale exercise), and an individual

engagement skill development exercise, giving individual soldiers a chance to practice tactical firing.

Other research found a significant positive relationship between higher levels of aptitude and soldier lethality (Whitmarsh & Sulzen, 1989). The TES field training research demonstrated that the value of added training time or repeated practice for engagement skills greatly increased the odds of winning offensive battles (Hart & Sulzen, 1988; Sulzen, 1987; Sulzen, Whitmarsh, & Hart, 1989).

To verify the value of TES training for the Army, ARI undertook a series of comparisons using TES training for the experimental group, and conventional training for the control group. These tests were conducted for rifle squads; tank platoons, supported by antitank weapons; and combined arms teams. In each of these comparisons, TES demonstrated superior training performance.

The value of repetition in TES was verified for the Army by analyzing a series of simulated battles comparing well practiced units and units less well trained. The results were striking (see Table 2).

**Table 2**

*The Relative Odds of a Well-Trained Unit Winning an Offensive Battle for Differing Echelons*

Echelon of Exercise	Relative Odds of Winning a Battle	Number of Battles Conducted
Rifle Squad	49 to 1	187
Rifle Platoon	30 to 1	237
Company Team	15 to 1	58
Battalion Task Force	5 to 1	428

Note that the odds of winning decrease as the size of the organization increases. One hypothesized cause of this phenomenon is that the battle fought by larger organizations is more complex and includes factors such as increasingly difficult military decision-making.

In a collaboration with the senior mechanized trainer at the NTC, a defense technique of fire power concentration was described as an effective training process (Graney & Sulzen, 1989). Finally, in response to a request from Major General Burba (7th Infantry Division Commander at the time), training development assistance was provided and documented as an effective training methodology for preparing for the Joint Readiness Training Center (Sulzen & Rassmussen, 1991). The training methods included a modification of the earlier TES individual engagement skill exercise into a "two-on-one" exercise, and a series of repeated practice rifle squad movement to contact exercises.

The contribution the ARI-NTC Research Team/Element has made to Army tactical training has been substantial and enduring. In suggesting to the Senate Armed Service Committee the direction future Army training should go, Gorman and McMaster (1992) made reference to the TES training research as evidence of critical learning gained during these exercises.

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Graney, P. T., Jr., & Sulzen, R. H. (1989). Weapons positioning: The circular technique. *Infantry*, 79(1), 11-14.

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Meliza, L. L. (1988b). *National Training Center guidebook for live fire mobility observer/controllers*. Fort Irwin, CA: Operations Group, National Training Center.

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Sulzen, R. H. (1988b). *National training center guidebook for battalion/task force intelligence observer/controllers during live fire*. Fort Irwin, CA: Operations Group, National Training Center.

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Sulzen, R. H., & Rassmussen, S. C. (1991, January). Centralized battalion evaluations. *Military Review*, 71(1), 36-43.

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Whitmarsh, P. J., & Sulzen, R. H. (1989). Prediction of simulated infantry-combat performance from a general measure of individual aptitude. *Military Psychology*, 1(2), 111-116.

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Gorman, P. F. , & McMaster, H. R. (1992). *The future of the armed services training for the 21st century*. Statement before the Senate Armed Services Committee, 21 May 1992. Washington, DC.

Sulzen, R. H. (1988c, April). *Development of parsimonious and effective training for military leaders*. Paper presented at the meeting of the American Educational Research Association, New Orleans.

Sulzen, R. H. (1988d, November). *Development of observer/controller (O/C) guidebooks*. Paper presented at the meeting of the Military Testing Association, Arlington, VA.

Sulzen, R. H., Whitmarsh, P. J., & Hart, R. J. (1989, March). *Effects of repetitive training on simulated combat outcomes for rifle squads*. Paper presented at the meeting of the American Educational Research Association, San Francisco.

Whitmarsh, P. J. (1988c, November). *Prototype electronic clipboard software and hardware for the combat training center*. Paper presented at the meeting of the Military Testing Association, Arlington, VA.

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# Fort Irwin Personnel History

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## Establishment

The ARI-NTC Research Team at Fort Irwin was established on June 20, 1986, as a result of a Letter of Agreement between ARI and the Combined Arms Command Deputy Commander-Training (CAC-TNG), Fort Leavenworth, Kansas. In the agreement, ARI agreed to provide personnel in support of the CALL mission of providing information from the NTC that would assist in the improvement of Army doctrine, training, organization, material, and leadership.

## Staff

The personnel and positions staffing the ARI-NTC Research Team/Element were as follows:

Dr. Robert H. Sulzen, Team Leader  
Mr. Patrick J. Whitmarsh, Research Psychologist  
Mrs. Diana L. M. Nelson-Falkner, Secretary  
Mrs. Barbara J. Nicklas, Secretary

The Fort Irwin Research Element was closed June 10, 1996.